Catalogue of American Amphibians and Reptiles.

Beaman, K.R. and E.A. Dugan. 2006. *Crotalus ruber.*

Crotalus ruber Cope
Red Diamond Rattlesnake

Crotalus adamanteus atrox: Cope 1875:33 (part).
Crotalus exsul: Garman 1884 [dated 1883]:114.
Crotalus adamanteus ruber Cope 1892:690. Type-locality not given, restricted to "Dulzura, San Diego County, California," by Smith and Taylor (1950). Holotype, National Museum of Natural History (USNM) 9209, adult male, collector and date of collection not given (not examined by authors).
Crotalus atrox ruber: Stejneger 1895:439.
Crotalus ruber: Van Denburgh 1896:1007.
Crotalus lucasensis Van Denburgh 1920:29. Type-locality, "Agua Caliente, Cape Region of Lower [Baja] California, Mexico." Holotype, California Academy of Sciences (CAS) 45888, adult male, collected by J.R. Slevin on 26 July 1919.
Crotalus atrox lucasensis: Schmidt 1922:698.
Crotalus atrox elegans Schmidt 1922:699. Type-locality, "Angel de la Guardia Island, Gulf of California" [Mexico]. Holotype, National Museum of Natural History (USNM) 64452, age and sex not given, collected by C.H. Townsend on 10 April 1911.
Crotalus exsul ruber: Kallert 1927:372.
Crotalus ruber ruber: Klauber 1949:59.
Crotalus ruber lucasensis: Klauber 1949:59.
Crotalus ruber lorenzoensis Radcliffe and Maslin 1975:490. Type-locality, "San Lorenzo Sur Island in the Gulf of California, Baja California Norte, Mexico." Holotype, San Diego Society of Natural History (SDSNH) 46009, adult male, collected by C.E. Shaw on 23 May 1966.
Crotalus ruber elegans: Harris and Simmons 1978: 121.
Crotalus ruber monserratensis Harris and Simmons 1978:122. Type-locality, "Isla Monserrate, Gulf of California, Baja Sur, Mexico." Holotype, Herbert S. Harris/Robert S. Simmons (HSH/RSS private collection) RS 1217, adult male, collected by J. Nyhan during July 1976.
Crotallus ruber: Hagey 1992:36. *Lapsus.*
Crotalus exsul exsul: Grismer 1994b:71.
Crotalus exsul lucasensis: Grismer 1994b:71.
Crotalus exsul lorenzoensis: Grismer 1994b:71.
Crotalus ruber rubber: Ramos and Selistre-de-Araujo 2004:527. *Lapsus.*

• **CONTENT**. No subspecies are recognized, *sensu* Grismer (2002).

• **DEFINITION**. *Crotalus ruber* is a moderately large species of rattlesnake, with a maximum recorded length of at least 1620 mm (there are reports of specimens measuring 1830 mm [Klauber 1930b] and an unconfirmed report of 1905 mm [Sibly 1951]). The scutellation is as follows: 25–33 scale rows at mid-





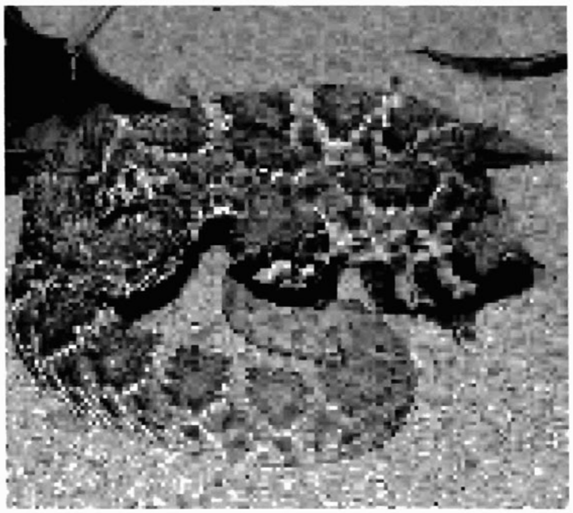
Figure 1. *Crotalus ruber* from Chino Hills State Park, San Bernardino County, California, USA (above); *Crotalus ruber* from the Jacumba Mountains, Imperial County, California, USA (below). Photographs by E.A. Dugan.

body (usually 27 or 29), all keeled except lowermost 1–2 rows; 179–206 ventrals (179–203 in males; 183–206 in females); 15–29 subcaudals (20–29 in males; 15–26 in females), usually entire, but last few may be divided; 12–19 supralabials (usually 16); 13–21 infralabials (usually 17–18; the first infralabial is usually divided transversely); intergenials usually absent; 2–4 internasals; 1–2 nasals; 1–3 loreals; 2 (rarely 3) preoculars; 3 postoculars; 4–9 rows of intersupraoculars; 6–12 prefoveals; 4–5 interoculabials; 12–13 rattle fringe scales. The rostral is variable, being higher than wide, of equal width and height, or wider than high, and is in contact with the prenasals. The prenasals are usually in contact with the first supralabials, but can be separated from them, partially or entirely, by prefoveals. The preoculars are typically not in contact with the postnasals, being separated by loreals and canthals.

The dorsal ground color is variable and ranges from pink, light red, brick red, reddish brown, tan, brown, chestnut brown, brownish yellow, olive brown, or grayish brown. There are 20–42 dorsal body blotches (longitudinally oval, subhexagonal, diamond-shaped, or rhomboid-shaped) that may be reddish, dark red,



Figure 2. *Crotalus ruber* from Isla Cedros, Baja California, México (above); *Crotalus ruber* from Santiago, Baja California Sur, México (below). Photographs by L.L. Grismer.

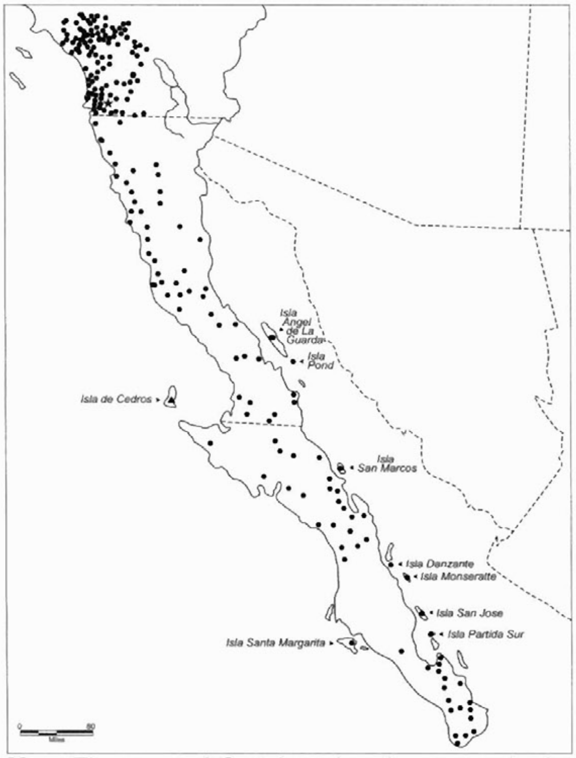


reddish brown, or olive brown. The blotches (mostly anterior) are often bordered (sometimes indistinctly) by a pale colored row of scales that may be tan, straw-yellow, or white. Secondary and tertiary series of blotches are frequently present and are often brownish red. The ventral surface can be yellow, cream, buff, pink, or salmon-colored and is often faintly clouded or suffused with pale brown or grayish brown. There are 2–7 black or dark brown tail rings superimposed on a ground color of white to ash gray. The dark tail rings are typically equal in width to the paler interspaces. When the dark tail bands incompletely encircle the tail, they are usually broken dorsally, not laterally. The proximal rattle segment is black. The head may be unicolored or irregularly mottled with dark pigment. A pronounced postocular stripe may be present in the form of pale lines extending from the eye downward to the border of the mouth. Speckling or mottling, to varying degrees, occurs on the head and body.

• **DIAGNOSIS**. *Crotalus ruber* may be distinguished from all other congeners by having the first pair of infralabials usually divided transversely. In the northern part of its range, the ground color is generally pinkish red, pale brick red, or reddish brown and is diagnostic in comparison with the ground colors of sympatric *C. viridis* and *C. mitchellii* and parapatric *C. atrox*. In the southern part of its range, from San Diego south to Cabo San Lucas, where it occurs sympatrically with *C. viridis* (to Guerrero Negro), *C. mitchellii*, and *C. enyo*, the contrasting black-and-white tail rings of *C. ruber* are diagnostic for this species.

• **DESCRIPTIONS**. Descriptions of *Crotalus ruber* are in Cope (1862, 1892, 1900), Stejneger (1895), Van Denburgh (1897, 1920, 1922), Schmidt (1922), Klauber (1930b, 1949, 1956, 1972), Gloyd (1940), Cliff (1954b), Stebbins (1954), Wright and Wright (1957), Radcliffe and Maslin (1975), Campbell and Lamar (1989, 2004), Ernst (1992), Jennings and Hayes (1994), Mattison (1996), Grismer (2002), and Ernst and Ernst (2003). Descriptions of habitat were published in Klauber (1930a, 1934), Savage (1959), Stebbins (1954, 1966, 1972, 1985, 2003), Lindsay (1964), Behler and King (1979), Armstrong and Murphy (1979), Campbell and Lamar (1989, 2004), Ernst (1992), Mattison (1996), Brown (1997), McPeak (2000), Grismer (2002), and Ernst and Ernst (2003).

• **ILLUSTRATIONS**. Black-and-white photographs of *Crotalus ruber* were published by Van Denburgh (1922), do Amaral (1927, 1928), Klauber (1927, 1930b, 1934, 1936b, 1956, 1972, 1982), Ditmars (1931), Gloyd (1940), Schmidt and Davis (1941), Pope (1944), Pickwell (1948), Shaw (1948), Perkins (1938, 1949a), Schmidt and Inger (1957), Wright and Wright (1957), Minton et al. (1968), Glaser (1970), Leviton (1972), Breen (1974), Caras (1974), Shaw and Campbell (1974), Harris and Simmons (1977, 1978), Glenn and Straight (1982), Russell (1983), Brown (1991), Ernst (1992), Baumann (1993), and Grismer et al. (1994). Additional black-and-white photographs include: **dorsal scale pattern** (Van Denburgh 1920, Ditmars 1939); **habitat** (Klauber 1956, 1972, Harris and Simmons 1977, Armstrong and Murphy 1979); **hybrids** (Russell 1983); **male combat behavior** (Shaw 1948, Pope 1955, Schmidt and Inger 1957, Shaw and Campbell 1974); **skull** (Klauber 1936b, 1939, 1956, 1972); **rattles** (Rabatsky 2006); **tail banding** (Klauber 1930b, Ditmars 1939). Color photographs were published by Schmidt and Inger (1957), Stanek (1960), Klauber (1972), Shaw and Campbell (1974), Behler and King (1979), Trutnau (1981), Phelps (1981), Mehrtens (1987), Campbell and Lamar (1989, 2004), Flournoy (1990), Greene (1990), Ernst (1992), Mara (1993), Milner (1993), Rossi and Rossi (1994), Mattison (1996), Brown (1997), Fisher and Case (1997), Rubio (1998), McPeak (2000), Grismer (2002), and Ernst and Ernst (2003). Black-and-white drawings are in Stebbins (1972) and Ransom (1981) and color drawings in Stebbins (1966, 1985, 2003) and Smith and Brodie (1982). Line drawings appeared in Van Denburgh (1897), Cope (1900), Eibl-Eibesfeldt (1961), and Brown (1997). Line drawings depicting the first infra-



Map. The range of *Crotalus ruber*; the star marks the type-locality and dots indicate other records.

labials appeared in Ballinger and Lynch (1983) and Powell et al. (1998).

• DISTRIBUTION. *Crotalus ruber* ranges from extreme southeastern Los Angeles County, east and southeast through Orange, extreme southwestern San Bernardino, western Riverside, San Diego, and extreme southwestern Imperial counties, California, south through Baja California, Mexico (except for the desert flats east of the Sierra Juárez in northeastern Baja California) to Cabo San Lucas, in Baja California Sur. *Crotalus ruber* also occurs on the following islands in the Gulf of California: Angel de La Guarda, Pond, San Lorenzo Sur, San Marcos, Danzante, Monserrate, and San Jose and on Isla de Cedros and Isla Santa Margarita on the Pacific coast of Baja California Sur. Distributional notes have been made by Yarrow (1883), Van Denburgh (1895), Cope (1896), Meek (1905), Atsatt (1913), Grinnell and Camp (1917), Stephens (1921), Klauber (1924, 1927, 1929, 1930b, 1936b, 1949, 1956, 1972, 1982), Ditmars (1930, 1931, 1936, 1939), Linsdale (1932), Slevin (1934), Martín del Campo (1935, 1950), Mosauer (1936), Hoard (1939), Gloyd (1940), Tevis (1944), Smith and Taylor (1945), Pickwell (1948), Scortecci (1953), Cliff (1954a,b), Lowe and Norris (1954), Stebbins (1954, 1966, 1985, 2003), Murray (1955), Cagle (1957, 1968), Schmidt and Inger (1957), Wright and Wright (1957), Blair (1958), Neill (1958), Savage (1959), Lindsay (1962, 1964, 1966), Klemmer (1963), Leviton (1964), Carlquist (1965), Hoge (1966), Orr (1965), Soulé and Sloan (1966), Minton et al. (1968), Russell (1969a), Glaser (1970), Bostic (1971), Freiberg (1972), Leviton (1972), Brown (1974), Hoge and Romano (1971), Bostic (1975), Welsh (1976, 1988), Harris and Simmons (1977, 1978), Goodrich et al. (1978), Hoge and Romano-Hoge (1978/79), Armstrong and Murphy (1979), Cornett (1979), Behler and King (1979), Underwood (1979), Kisser (1980), Seib (1980), Kilmon (1981), Habermehl (1981), Julia Zertuche (1981), Phelps (1981), Williamson (1981), Glenn and Straight (1982), Murphy (1983c), Murphy and Ottley (1984), Welsh and Bury (1984), Alvarez Solórzano and Gonzalez Escamilla (1987), Marlow (1988), Alvarez Cárdenas et al. (1989, 1990), Campbell and Lamar (1989, 2004), Flores Villela and Hernández Gomez (1990a,b), Grismer (1990, 1993, 1994a,b,c, 2002), Ernst (1992), Flores Villela (1993), Golay et al. (1993), Grismer and Mellink (1994), Jennings and Hayes (1994), Mattison (1996), Brown (1997), Wong (1997), Rubio (1998), McPeak (2000), Mellink (2002), Anonymous (2003), and Ernst and Ernst (2003). Wong (1997) commented on insular records of *C. ruber* [as *C. exsul*].

• FOSSIL RECORD. None.

• PERTINENT LITERATURE. Various aspects of the biology of *Crotalus ruber* are as follows: **behavior** (Bogert 1941, Brattstrom 1965, Brown 1997, Cardwell et al. 2005, Carpenter 1986, Carpenter and Ferguson 1978, Carpenter and Gillingham 1975, Chiszar et al. 1983, 1986, Ditmars 1936, 1939, Eibl-Eibesfeldt 1961, Ernst 1992, Ernst and Ernst 2003, Ferguson 1977, Fisher and Case 1997, Greene 1988, 1990, Grismer 2002, Hinton 1956, Hollingsworth and Mellink 1996, Klauber 1956, 1972, Lowe 1942, McPeak 2000, Pequegnat 1945, Rubio 1998, Shaw 1948, Tevis 1943, Weldon and Burghardt 1979, and Wright and Wright 1957); **captive management** (Perkins 1943, 1948, 1950, 1951a, 1952, 1953, 1954, 1955, Schmidt and Inger 1957, Shaw 1957a,b, Kauffeld 1965, Pawley 1971, Glenn et al. 1972, Bowler 1977, Murphy and Armstrong 1978, Anonymous 1981 [1980], Frye 1981, Olney et al. 1981, Murphy 1982, Varela Julía and Méndez del Castillo 1983, Mattison 1988, Snider and Bowler 1992, Slavens and Slavens 1993, and Rossi and Rossi 1994); **conservation** (Anonymous 2003, Tryon 1986, Flores Villela and Gerez Fernández 1988, Halama et al. 2005, 2006, and Ortega Rubio et al. 1990); **diet** (Van Denburgh and Slevin 1921, Klauber 1934, 1956, 1972, Tevis 1943, Stebbins 1954, 1966, 1985, 2003, Cowles and Phelan 1958, Cunningham 1959, Behler and King 1979, Flores Villela 1980, Patten and Banta 1980, Vaughan and Schwartz 1980, Hammerson 1981, Patten 1981, de Cock Buning 1983, Chiszar et al. 1986, Ernst 1992, Brown 1997, Grismer 2002, and Ernst and Ernst 2003); **ecology** (Brehme 2003, Van Denburgh 1922, Mosauer 1935, Gloyd 1940, Schmidt and Davis 1941, Perkins 1949a, Stebbins 1954, 1966, 1985, 2003, Wright and Wright 1957, Dullemeijer 1961, Mayhew 1963, Case 1975, 1982, 1983, 2002, Remington 1968, Armstrong and Murphy 1979, Behler and King 1979, Vaughan and Schwartz 1980, Trutnau 1981, Cody 1983, Marlow 1988, Campbell and Lamar 1989, 2004, Daly et al. 1990, Greene

1990, Ernst 1992, Jennings and Hayes 1994, Rossi and Rossi 1994, Greenberg 2002, 2005, McPeak 2000, Grismer 2002, Haas et al. 2002, Anonymous 2003, Ernst and Ernst 2003, Grajales-Tam et al. 2003, Brown et al. 2005 in press, Dugan and Hayes 2005, Halama et al. 2005 in press, Dugan et al. in press, and Tracey et al. 2005); **evolution** (Aldridge and Duvall 2002, Cliff 1954a,b, Gans 1978, Grismer 1999a, Hagey 1992, Mayr 1942, Murphy 1976, 1982, Murphy and Aguirre Léon 2002, Murphy et al. 1989, 2002, and Savage 1960); **genetics** (Murphy 1982, Murphy and Crabtree 1985, Stewart et al. 1990, and Murphy et al. 1995); **morphology** (do Amaral 1927, Ditmars 1930, 1936, 1939, Klauber 1931, 1936a,b 1937, 1938, 1939, 1940a, 1941, 1943a,b, 1949, 1956, 1972, 1982, Gloyd 1940, Pickwell 1948, Dowling 1951, Perkins 1951b, Cliff 1954b, Murray 1955, Cagle 1957, 1968, Schmidt and Inger 1957, Brattstrom 1959, 1964, 1965, Altman and Dittmer 1962, Neill 1963, Van Bourgondien and Bothner 1969, Barrett et al. 1970, Grassé 1970, Smith and Holland 1971, Dullemeijer and Poval 1972, Radcliffe and Maslin 1975, Jackson et al. 1976, Case 1978, De Lisle 1978, Harris and Simmons 1978, Kochva 1978, Karges 1979, Kisser 1980, Fitch 1981, Phelps 1981, Andrews 1982, Ottley and Murphy 1983, Glenn and Straight 1985, Mattison 1986, Ernst 1992, Grismer and Mellink 1994, Murphy et al. 1995, Rubio 1998, McPeak 2000, Grismer 2002, Ernst and Ernst 2003, Meszler et al. 2004, Rabatsky 2005, Kearney and Rieppel 2006); **paleobiogeography** (Douglas et al. 2006, Johnson 1978, Murphy 1982, 1983a,b); **paleontology** (Auffenberg 1963 and Miller 1980); **parasitology** (Goldberg and Bursey 1999, Rego 1980/1981, Riley and Self 1979, Schroeder 1934, Zwart et al. 1970); **pathology** (Murphy 1973, Jacobson 1980, 1981, and Machotka 1984); **physiology** (Andrews 1982, Auker et al. 1983, Bullock and Cowles 1952, Clarke and Marx 1960, Cohen 1975, Cowles and Phelan 1958, Dessauer 1970, Kochva 1978, Laszlo 1980, Lillywhite and Smits 1992, Skoczylas 1978, and Zeller 2004); **reproduction** (Klauber 1936a, 1937, 1956, 1972, Perkins 1943, Stebbins 1954, 1966, 1985, 2003, Mertens 1956, Wright and Wright 1957, Altman and Dittmer 1962, Tryon 1978, Armstrong and Murphy 1979, Fitch 1970, 1981, 1985, Harris and Simmons 1972, Mattison 1988, Ernst 1992, Brown 1997, Goldberg 1999, Aldridge and Duvall 2002, Grismer 2002, and Ernst and Ernst 2003); **systematics and taxonomy** (Garman 1884, Guibé 1970, Boulenger 1896, Mocquard 1908-1909, Werner 1922, 1923, Klauber 1930c, 1956, 1963, 1972, Cliff 1954a,b, Brattstrom 1964, Marx and Rabb 1972, Foote and McMahon 1977, Harris and Smith 1979, McCranie and Wilson 1979, Underwood 1979, Phelps 1981, Marx et al. 1982, Murphy and Ottley 1984, Stille 1987, Ernst 1992, Golay et al. 1993, Grismer et al. 1994, Brown 1997, Smith et al. 1998, McDiarmid et al. 1999, Minton et al. 1999, Anonymous 2000, Grismer 2002, Ernst and Ernst 2003, Beaman and Spencer 2004, and Castoe and Parkinson 2006, Castoe et al. 2007); **venom** (Barker 1964, Boquet 1964, 1970, 1979, Brown 1973, Bücherl and Buckley 1971, Bücherl et al. 1968, Clarke 1961, Criley 1956, Devi 1971, do Amaral 1928, Elliott 1978, Foote and McMahon 1977, Gans 1978, Gingrich and Hohenadel 1956, Githens and Butz 1929, Githens and George 1931, Glaser 1948, Glenn et al. 1973, Iwanga and Suzuki 1979, Klauber 1928a, 1956, 1972, Leviton et al. 1964, Lyons 1971, Marshall and Williams 1994, McCue 2005, Meaume 1966, Mebs 1978, Minton 1956, 1968, 1990, Minton and Minton 1969, Offerman et al. 2003, Parnas and Russell 1967, Pirkle 1998, Pope 1944/1945, Russell 1967, 1969b, 1979, 1980, 1983, Russell and Brodie 1974, Russell et al. 1960, 1962, 1970, Shaw 1957c, Sosa et al. 1979, Strauss and Grunbaum 1961, Tu et al. 1967, Tu and Homma 1970, Shaw and Campbell 1974, Tu 1977, 1991, Read et al. 1978, Nikai et al. 2000, Ownby et al. 1979, Tay Zavala et al. 1980, Glenn and Straight 1982, 1985, Perez et al. 1984, 2001, MacKessy 1985, Henderson and Bieber 1986, Rael et al. 1986, Minton 1987a,b, Mori et al. 1987a,b, Rosenberg 1987, Bober et al. 1988, Mori and Sugihara 1988, 1989a,b, Takeya et al. 1990a,b, 1993, Wingert 1991, Ernst 1992, Straight et al. 1992, Obrig et al. 1993, Ownby et al. 1994, Turkington 1994, Maruyama et al. 1995, Ernst and Zug 1996, Rubio 1998, Tay Zavala et al. 2002, Ernst and Ernst 2003, Ramos and Selistre-de-Araujo 2004, Cardwell et al. 2005, and Lu et al. 2005).

Crotalus ruber has been included in the following **checklists, keys, and similar compendia**: Flower 1929, Smith and Taylor (1950), Slevin and Leviton (1956), Pregill and Berrian (1984), Stejneger and Barbour (1923, 1933, 1939, 1943), Smith and Taylor (1945), Schmidt (1953), Loomis et al. (1974), Harding and Welch (1980), Hoge and Romano-Hoge (1981), Jennings (1983, 1987, 2004), Murphy (1983c, 2002), Golay et al. (1993), Brown (1997), Rubio (1998), Grismer (1999b), Van Denburgh (1897), Brown (1901), Blanchard (1925), do Amaral (1929), Klauber (1930b, 1936b, 1952, 1956, 1971, 1972), Ditmars (1939), Perkins (1940, 1949a, 1949b), Schmidt and Davis (1941), Smith and Taylor (1945), Pickwell (1948), Savage (1948, 1949, 1959), Cliff (1954a,b), Stebbins (1954), Blair et al. (1957), Wright and Wright (1957), Sanborn and Loomis (1976), De Lisle (1978), Ballinger and Lynch (1983), Ernst (1992), Grismer (2002), Ernst and Ernst (2003), Klauber (1928b), Cuesta Terron (1931), Martín del Campo (1937, 1950), Wright and Wright (1952), Conant et al. (1956), Klemmer (1963), Rosenberg (1987), Sokolov (1988), Collins (1990, 1997, 2001), Collins et al. (1978, 1982), Liner (1994), Neill (1958), Pérez Avramow (1969), Smith and Smith (1976, 1993), Klauber (1940b), McCranie and Wilson (1979), and Beaman (1999).

• **ETYMOLOGY**. The name *ruber* (Latin) means "red", referring to the reddish ground color often exhibited by members of the species.

• **COMMENT**. Grismer et al. (1994) showed that *Crotalus ruber* and *Crotalus exsul* are names that apply to the same species, and recommended that

Crotalus exsul Garman 1884 be given priority. Smith et al. (1998) petitioned the International Commission on Zoological Nomenclature (ICZN) proposing the conservation of the name *Crotalus ruber* over *Crotalus exsul,* which was subsequently upheld (Anonymous 2000).

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Primary editor for this account, Larry David Wilson.
